DOCUMENT RESUME

ED 207 672 PS 012 316

AUTHOR	Wade, Michael G.; Davis, Walter E.
TITLE	Motor Skill Development in Young Children: Current Views on Assessment and Programming.
INSTITUTION	ERIC Clearinghouse on Elementary and Early Childhood Education, Urbana, Ill.
SPONS AGENCY	National Inst. of Child Health and Human Development (NIH), Bethesda, Md.; National Inst. of Education (ED), Washington, D.C.
PUB DATE	81
GRANT	400-78-0008; NICHHD-HD-05951
NOTE	32p.; To be published as a chapter in "Current Topics in Early Childhood Education," Volume IV, 1982, Lilian G. Katz, Editor.
AVAILABLE FROM	Ablex Publishing Corporation, 355 Chestnut Street, Norwood, NJ 07648 (Contact publisher for price).
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Developmental Programs; Early Childhood Education; *Evaluation Methods; *Motor Development; Movement Education; *Needs Assessment; Perceptual Motor Learning; *Psychomotor Skills; Testing; Theories
IDENTIFIERS	Reflexes

ABSTRACT

After a brief overview of theory related to motor skill development in children, an update on approaches to motor development assessment and programming is provided. Descriptive/product, process-oriented/diagnostic, process/descriptive, and reflex testing approaches taken in motor ability assessment are reviewed, and some of the strengths and limitations of each approach are discussed. In the descriptive or product-oriented approach a group of motor tasks is selected, and each child's performance is compared with the average performance of children in his or her age group. The process-oriented or diagnostic approach consists of evaluating tasks which are indicative, in theory, of an underlying process of motor performance. In the third approach children's activities are observed, and their performance is judged on the basis of a qualitative analysis of their movement patterns. Reflex testing evaluates children on the bases of the appearance and/or inhibition of certain reflex movements according to age level. In conclusion, three approaches to programming motor activities for the young child--including traditional, movement education, and perceptual approaches--are delineated and contrasted. (Author/RH)

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ED207672

Motor Skill Development in Young Children: Current Views on Assessment and Programming*

Michael G. Wade
Southern Illinois University at Carbondale

Walter E. Davis
Kent State University

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Developmental changes in a young child's motor skills are evident in the manipulatory and ambulatory activities the child exhibits. Motor skill development is an extremely important issue in the overall development of the child for often a failure to manifest appropriate motor behavior is a signal that cognitive function may be impaired. A typical motor problem that might reflect a more general cognitive impairment is hypotonia -- muscle flaccidity. (For a fuller discussion, see below). Often general slowness in acquiring age appropriate motor skills also reflects some degree of cognitive impairment. This chapter provides a brief theoretical background to motor skill development in children, and also provides an update on the approaches to the assessment and programming of motor development.

Theoretical Background

Historically, those interested in the study of motor skill behavior have viewed motor learning and motor development as distinct entities. The former has borrowed heavily from experimental psychology for its theoretical formulations and orientations and has concentrated on experimentally manipulating such variables as practice, feedback, age,

* The support for this article came from NICHHD Program Project Grant #HD05951 awarded to the author

Paper prepared for the ERIC Clearinghouse on Elementary and Early Childhood Education.

PS012316

and sex of subjects, and measuring performance change. Those theorists who have focussed on motor development have held fast to the traditional stage dependent theory of the developing child and have drawn ideas and orientations from both clinical and differential psychology. The clinical aspect is evident in the use of observational scales with children as their motor abilities develop. The differential aspects stem from the considerable research energy which has been devoted to the construction of diagnostic tests to determine the "motor age" of a young child, and to evaluate whether or not the child's motor skills are developing according to the appropriate sequence. Thus, motor development theorists have relied more heavily than motor learning theorists on correlational procedures to investigate relationships between variables such as age and sex and performance on motor skill tasks.

The traditional maturational frameworks that have been used to describe patterns of motor development in children have relied primarily on a neurologically based explanation of developing activity; that is, the appearance of motor milestones (sitting, standing and walking) is largely determined by the maturation of the nervous system (Coghill, 1929; McGraw, 1945). These traditional views have more recently been critized by Schneirla (1966) and Connolly (1970a) for failing to give sufficient theoretical importance to the effects of motor experience on the developing organism. Results from animal studies (Bridgeman & Carmichael, 1935; Carmichael, 1934; Windle, 1940) all point to both general and localized responses occurring in the life of the

organism, suggesting that progressive refinements of the developing organism's motor responses come about not only from a process of maturation but also from the effects of experience. Present day theorists in motor development (e.g., Halverson, Roberton, & Harper, 1973), who operate within stage theory recognize the role of both experience and maturation. Their major focus is on describing sequences both within and across motor skills.

With the advent of information theory (Shannon & Weaver, 1949), research on motor skill behavior developed a new language. Emphasis was placed on the individual's ability to process information. The individual was compared to a communication channel (much like a telephone switching center) with a limited capacity to process information. Research findings in the motor development literature (Connolly, 1970b; Wade, 1976) suggest that as processors of information, children are considerably less efficient than adults. For example, when children are required to perform a motor skill (i.e., solve a motor problem), they are faced with a larger and probably very different matrix of information, and what appears simple to adults may be highly complex to children. For adults, their wider sphere of experience tends to rule out a number of hypotheses or strategies that remain conceivable to the young child faced with an identical motor problem. For example, in early game playing with a ball, children tend to "chase" the ball rather than position themselves where the ball will eventually finish. Such lack of anticipation is often a reflection of what is termed information overload for children. In informational terms, children

have no redundancy (information already processed) in their systems and must therefore process more information than adults in coping with the same problem. Although it has limitations (Connolly, 1970a; Wade, 1976), the information theory model of skilled behavior has allowed for the investigation of learning strategies which the developing child uses to develop appropriate motor skill behavior and has provided a working model to study the process variables that contribute to the learning and development of motor activity skills.

Recently a less conventional perspective has been advanced by students of Gibson (1966). Turvey, Shaw, and Mace (1978), Fowler and Turvey (1978), Fitch and Turvey (1977) and Kugler, Kelso, and Turvey (1980) all maintain motor skill behavior can best be understood when a person is viewed within the environmental context in which he or she resides. Fundamental to this interpretation is the notion that our actions and perceptions are body-scaled.

The central idea behind body-scaled information is that objects which are perceived by the organism are defined relative to the organism's capacity for activity. Objects are distinguished not along geometrical dimensions but along activity-related dimensions. The use of the term information is owing to Gibson (1966) and does not reflect the traditional Shannon and Weaver (1949) interpretation. Conventially the term information reflects the idea of a limited capacity to process information as discussed above, but Gibson's use of the term defines information as the correspondence between environmental properties as they relate to the organism and the energy medium (e.g., light). Thus the metrics

of activity within the environment are not related to some abstract and animal independent scale (such as feet, inches, feet per second, or pounds-weight) but are environmentally and animal functional. An object passing across the visual field is not perceived as traveling at so many feet per second, at least at the first order level, rather questions are asked of the moving object as it relates to the organism-- for example, "Can I reach it?" "Can I catch it?" "When will it hit me?" In other words ,the organism acting within the environment asks "time to contact" questions of the moving object. This kind of perspective is particularly important in the wide range of motor activities which require accurate anticipatory or coincident timing behavior, such as catching and hitting balls and other moving objects.

ASSESSMENT OF MOTOR DEVELOPMENT

The importance of assessment in education is well established in both theory and practice. Assessment is conducted for such purposes as student placement, program planning and evaluation, and group comparisons. It is little wonder then, that so much time and effort has been put into the development and refinement of assessment instruments of both the motor and cognitive domains (see Ebel, 1973). Indeed, much of the assessment of early development focuses on the motor area since (1) motor abilities are more easily and reliably observed at a very early age than are cognitive abilities; and (2) motor development is held by many to be the foundation of later cognitive development (see Piaget, 1952).

Despite the existence of a large number of instruments designed

to measure motor abilities (over 300 by some counts), motor assessment is not as widespread as one might expect, and this is especially true for handicapped populations (Lewko, 1976). Also there are a number of shortcomings in both the construction and use of motor assessment instruments. In this section four major approaches taken in motor ability assessment are reviewed and some of the strengths and limitations associated with each approach are discussed. First, is the descriptive or product oriented approach in which a group of motor tasks is selected and each child's performance is compared with the average performance of children in his or her age group category. Scores reflect the final or end product of performance such as the number of times the child catches a tossed ball. The second approach, termed process oriented or diagnostic, consists of evaluating tasks which are indicative of an underlying process of motor performance based on theoretical postulates. In the third approach, children are observed in activities such as running, throwing, and catching, and their performance is judged on the basis of a qualitative analysis of their movement patterns. The criterion measure in this case would be a mature or age appropriate pattern (e.g., the appropriate temporal/spatial relationships among body segments which occur during performance). In reflex testing, the fourth approach, children are evaluated on the bases of the appearance and/or inhibitation of certain reflex movements according to age level.

Descriptive Approach

The descriptive or product oriented approach is traditional and based primarily on the concept that motor development follows an orderly sequence. The sequential pattern is marked by "motor milestones " (i.e., the ability to perform specific tasks such as crawling, sitting, running, jumping, and throwing). It is assumed that all children, unless severely neurologically or physically impaired, will pass through this motor sequence, although the age at which each milestone is achieved will vary. Thus, assessment scales are developed which include a number of these motor milestones and the age range in which they should appear. Children are observed as to whether they can or cannot perform each task and are then compared with the average ability child of their age group.

The motor sequence and age ranges for these tests have been determined by the careful collection of descriptive data and the charting of progress across chronological age. The pioneer work of Shirley (1931), Bayley (1935), McGraw (1945), Gesell (1940) and others is still influential in the construction of tests of this type.

The need for quick and efficient methods to assess children at an earlier age has grown as the number of remedial education programs have grown. The Bayley Scales (Bayley, 1969), Gesell Schedules (Gesell & Armatruda, 1949) and similar traditional instruments require considerable expertise to administer and interpret, are time consuming, and require expensive equipment. As a result, a number of tests have been constructed as screening instruments and have been primarily modifications of the Bayley and Gesell tests. Screening instruments, by

definition, include a minimal number of items and are used to identify children at risk or in need of remediation. The items should well represent the assessment domain but the test must allow for quick and easy administration so that it can be used with large numbers of children.

One of the most popular of these instruments is the Denver Developmental Screening Test (DDST) (Frankenburg & Dodds, 1966). The test is administered individually and assesses gross motor, fine motor-adaptive, language and personal-social abilities. Even though the DDST is one of the more widely used instruments, it has received considerable criticism from both researchers (e.g., Thorpe & Werner, 1974) and practitioners (see Lewko, 1976). One problem is that the DDST is often used with populations for which it not valid, and for diagnosis and program planning -- purposes for which it was clearly not designed. Thus, the DDST and similiar tests lack the reliability and validity (Herkowitz, 1976; Katoff & Reuter, 1980) required to make them suitable screening instruments. The Bayley and Gesell instruments, which are technically superior, have also been criticized (e.g., Herkowtiz, 1978) for failing to predict later performance. There are several factors which may contribute to the poor predictive power of these descriptive tests. One factor is that age criterion is not a valid measure of performance since physical and neurological growth rates, which constrain the acquisition of motor skills, vary considerably among children. Another problem is the subjective judging of the acquisition of motor milestones,

that is, standardizing methods of recording achievement. For example, there is little control over the various methods of prompting the child to respond such as modeling, giving verbal cues, or using manual guidance (see Ilmer & Drews, 1980).

One complaint from teachers of the handicapped is that the scoring systems of these instruments are not sensitive enough to measure changes in children whose progess is much slower than that of the average child. One attempt to alleviate this problem when testing the severly handicapped is seen in the recent work of Cohen and Gross (1979), who provide a more extensive breakdown of both fine and gross motor tasks. The disadvantage of this information is that the sequences are based on landmarks for normal child development and therefore may still be inadequate for use with multiply handicapped individuals (Mira, 1977).

Descriptive tests are of an actuarial nature in that they assess what the child can or cannot do, and therefore are most appropriately used as a screening device. Extreme caution must be exercised in using these tests for diagnostic purposes. The results of a good diagnostic test must not only indicate a motor deficiency when present but also must suggest remediation. Although aware of this need, practitioners and researchers alike often have a propensity for equating the name or label given a motor task with the process or underlying ability which predominately determines response outcome (Newell, 1976). Thus, for example, tasks labeled "balancing tasks" often are assumed to measure a child's balance ability.

Process Oriented/Diagnostic Approach

This section includes those tests whose purpose and design are diagnostic or process oriented. Some of these tests are oriented more toward gross motor tasks while others are weighted toward measuring "perceptual" attributes. The work by Oseretsky (see Doll, 1976) in Russia has had the greatest impact on motor ability testing of gross motor tasks. Oseretsky believed that motor ability is determined by neurological functioning and is primarily the responsibility of the brain. Thus, he reasoned that brain functioning could be assessed by observing a set of motor behaviors. His attempt to identify brain damage or "motor idiocy" resulted in an original test of six areas and included 85 tasks. The six areas were (1) general static balance (e.g., balancing on one foot); (2) dynamic manual (e.g., cutting a circle from paper or throwing a ball at a target); (3) general dynamic (e.g. jumping over a rope); (4) speed (e.g., making four piles with 40 match sticks as fast as possible); (5) simultaneous movement (e.g., tapping hands); and (6) dyskinesia (e.g., closing the eyes alternately). A composite score from all of the items in the test was converted into a "motor quotient" which indicated normal or abnormal motor development and in turn suggested the absence or presence of brain damage.

The Oseretsky Test was criticized because it failed to accurately identify brain damaged children (Geisler & Forster, 1960; Kiphard, 1969; both studies cited in Neuhauser, 1975). These researchers found that the six components were not actually separable and that the reliability in identifying children with brain damage was only 20 percent. Perhaps the strongest criticism of the original test was its extreme

length which made administration largely impractical.

The Oseretsky Test has since been adapted for use in other countries, particularly the United States (Doll, 1946) and Europe (see Nauhauser, 1975 for review). In these adaptations and subsequent revisions, researchers have attempted to correct many of the initial weaknesses described above. The most notable revisions in the United Stated have been the Lincoln (Sloan, 1955), Stott (Stott, Moyes, & Henderson, 1972) and the Bruininks-Oseretsky (Bruininks, 1978). The latter two revisions bear little resemblance to the original Oseretsky tests.

The Stott General Test for Motor Impairment (Stott, 1966; Stott, Moyes, & Henderson, 1972) was an attempt to develop a measure of functional or presumed neurological impairment. The methodology of these researchers was to test successive experimental revisions of the Oseretsky Test on sample populations of normal and handicapped children. The result was the complete exclusion of many items and an adjustment in the pass/fail criteria and/or age level for many other items (Henderson & Stott, 1977).

The Bruininks/Oseretsky contains eight subsets and 46 items. The subtests -- running speed and ability, balance, bilateral coordination, upper-limb coordination, response speed, visual-motor control, and upper-limb speed and dexterity -- are based on motor components derived from factor analytic studies. Besides the complete battery, a Short Form, which consists of 14 items from the battery, is available. The scoring is based on derived scores which are compared to age equivalents or standard scores differentiated by sex. The derived scores are obtained from the raw scores by using a conversion formula (Bruininks, 1978).

An assumption of the diagnostic oriented test approach is that motor skills are general rather than specific. In other words, there are underlying motor abilities which transfer from one skill to another. Therefore, the level of performance exhibited on one skill would be predictive of the level of performance on other skills relying on the same underlying ability. By properly identifying these abilities one could design tasks and develop an instrument to index general motor functioning. Under these assumptions, researchers, relying primarily on factor analytic studies (e.g., Bruininks, 1974; Fleishman, 1964; Rarick & Dobbins, 1975), attempted to identify these underlying abilities.

In the 1950s and early 1960s several psychologists and clinicians developed diagnostic tests weighted toward measuring perceptual-motor abilities. The most notable of these tests are the Purdue Perceptual Motor Survey (Roach & Kephart, 1966), the Southern California Sensory Integration Tests (Ayres 1964, 1974), Frostig's Development Test of Visual Perception (Frostig, Maslow, Lefever, & Whittlesey, 1963) and the Frostig Movement Skills Test Battery (Orpet, 1972). Featured on these tests are items purported to measure visual abilities (e.g., ocular control, form perception), body image and perceptual-motor match (e.g., eye-hand coordination, laterality and directionality). These researchers hypothesized that motor performance was directly tied to perceptual abilities which in turn were directly dependent on the central nervous system. Thus, it was held that nervous system function could be measured by assessing perceptual-motor ability.

Although these above tests are widely used (Lewko, 1977), they have come under heavy criticism. Researchers (e.g., Taylor, 1980) have found Frostig's Visual Perception Test not to measure five separate abilities as is assumed. Taylor also questioned whether the tasks (e.g., discrimination of 2-D geometric forms) tapped those perceptual abilities utilized by the child in reading and writing. The same criticism can be made with regard to motor development. It is questionable whether discrimination of 2-D geometric forms measures same perceptual ability as is required in running, jumping, and catching (see Gibson, 1979; Lee, 1978). Frostig and Ayres were also chided for failure to follow rigid standardization procedures and for making extensive and unsupported claims particularly in the development of their earlier versions (see reviews in Buros, 1971). In addition, some practitioners have found that these tests do not relate well to their curriculm and thus are of little use in program planning (see Lewko, 1976).

Process/Descriptive Approach

Due in part to the need for assessment procedures aligned closer to program implementation, a new approach, known as the process/description approach, has emerged (Herkowitz, 1976). This approach is aimed in particular at designing tests for identifying children whose motor movements are awkward and for testing mildly mentally handicapped children. Although this approach has not been fully developed nor thoroughly tested, it appears to hold some promise for aiding the practitioner.

In this type of test, each motor skill (e.g., throwing, catching, jumping) is selected from the program curriculm and assessed separately (e.g., Knowles, Vogel & Wessel, 1975). The child's performance is judged on an individual basis against an established criterion of either (e.g., Davis, 1980; Fait, 1978, p. 78) or according to a developmental pattern (e.g., Loovis & Ersing, 1980), rather than to an age criterion as used in standardizing testing. The selection of these is based on analysis of the temporal and spatial relationships of the body parts during the performance as described in the literature (see Wickstrom, 1977; McClenaghan & Gallahue, 1978). Thus, these testing procedures are considered to measure the process rather than the end product of performance but are descriptive rather than diagnostic.

A basic assumption in the approach is that this "mature pattern" is a biomechanically optimal performance and applies to most performers. A similar assumption is made regarding the developmental patterns which are sequential arrangements within the tasks rather than across tasks. Proponents of this type of test also adhere to the concept of motor specificity rather than generality. The notion of specificity has considerable research support, particularly that conducted by Franklin Henry during the 1950s (see Henry, 1958, 1960 for review).

Reflex Testing

Reflex behavior is a significant indication of motor development. It is fitting, therefore, that it is part of the assessment techniques used with children suspected of motor delay and/or mental retardation (see Newell, 1976; Molnar, 1978). Reflex testing as a major part of the

neurological examination has, until recently, been conducted within the clinical setting and has followed rather standard procedures (e.g., Fiorentino, 1976; Milani-Comparetti & Gidoni, 1967). Although the procedures are not difficult, an accurate interpretation of the results requires considerable training and experience. An appropriate use of reflex testing by trained educators is for them to do the initial identification of motor problems and to have a recommended follow-up evaluation done by a clinical specialist. Today, more and more children with motor problems are assessed in public school settings by special physical educators as well as by physical therapists; this assessment includes both reflex and motor evaluations.

In the clinical setting, reflex testing is only a part of the assessment battery used to determine the level of motor functioning and is considered to be a measure of the maturation of the neurological system. Two types of reflexes are evaluated, one of which is the "primitive" reflex. An example is the asymmetrical tonic neck reflex which is elicited in an infant by turning his or her head to one side. The normal response to this simple "stimulus" is an increase in flexor tone in the ipsilateral (same side) limbs and an increase in extensor tone in the contralateral (opposite side) limbs, thereby causing a degree of limb flexation and extension respectively. These reflexes are easily elicited at birth or shortly after and then become "integrated" into the nervous system as the child matures. Thus, changes in muscle tone may still occur slightly from the eliciting stimulus, involuntary limb movement is inhibited by other newly established neural pathways.

Persistence of these reflexes beyond the normal age range (after 4 to 8 months for most primitive reflexes) indicates neurological impairment, even though the exact nature of this deficit is not always apparent (Patton, 1977). Absence of these reflexes at the expected time, which is usually accompanied by muscle hypotonia (floppy infant syndrome) also indicates neurological deficits but is even less suggestive of specific problems. For example, muscle hypotonia could later develop into hypertonia (as in the case of infantile spasticity), remain indefinitely, or improve with age to a normal level of motor function (Swainman & Wright, 1979).

A second type of reflex assessed is the postural adjustment reaction or the supportive reflexes such as righting of the head in space. Another supportive reaction is derotative righting, an untwisting when a rotation is applied along the body axis. For example, if the pelvic girdle is rotated, the chest and head tend to follow reflexively. These reactions are well known to be important for the developing infant in achieving erect postures. Generally, body righting reactions begin to appear after 1 or 2 months of age in normal infants and continue to be present throughout their lives. From extensive observational studies of infants, researchers (e.g., Illingworth, 1968; Paine, Brazelton, Donovan, Droch, Hubbell, & Sears, 1964) have demonstrated a maturational sequence and timetable for the intergration of the primitive reflexes and for the appearance of postural adjustment reactions. Moreover, an assocation between the maturation of these reflexes and the attainment of motor milestones have been shown (Hoskins & Squires, 1973; Milani-Comparetti & Gidoni, 1967).

Reflex testing has most extensively been used in evaluating infants and children suspected of having some type of cerebral palsy, particularly spasticity (the most common type), since the persistence of primitive reflexes is most evident in these cases. Recently, Molnar (1978) also demonstrated the importance of using reflex testing with mentally handicapped children. Molnar found motor delay in retarded infants (with no evidence of a physical disability) to be associated with a delay in the appearance of postural adjustment reactions. The primitive reflexes were normal for her sample which led to the suggestion that the extended time between the dissolution of the primitive reflexes and the appearance of postural adjustment reactions contributed to the delayed motor skill development (Molnar, 1978).

As with the assessment of muscle tone and primitive reflexes, the observations of abnormal postural reactions alone do not provide sufficient information for determining precise deficits, for spinal, labyrnthine, and optical mechanisms all contribute to these automatic adjustment reactions in a cooperative and complex fashion.

PROGRAMMING MOTOR ACTIVITIES

Programming motor activities for the young child may be divided into three distinct approaches: the traditional approach, the movement education approach, and the perceptual motor approach.

The Traditional Approach

The traditional approach provides a logical series of formal motor activities that are in line with the presumed stages of the development

of the child's strength and stature. The acquisition of fundamental motor tasks (see Wickstrom, 1977) is usually observable during the preschool and early school years as children develop, but as children grow older, the level of analysis is often more complex in order to detect the subtle changes in both the character and the level of performance within each of these fundamental skills. As children progress into adolescence the variability of their motor performance increases as they change both socially and biologically at a rate that is different from their chronological age. In other words, after puberty, chronological age per se may not provide a clear and accurate prediction regarding a child's capacity to perform a motor skill activity, because strength and growth rates vary more during this period. Thus, chronological age may sometimes be a misleading criterion for the study of changes in motor behavior.

Development in motor behavior from ages 5 years through 18 years is reflected by improvements on six fundamental groups of motor abilities. These are jumping, running, throwing, catching, balancing, and kicking. Dispersed among these fundamental motor abilities are a variety of other skills (e.g., speed, dexterity) in which children show improvement. Boys tend to improve in these skills up to the age of 18 years while girls show improvement only up to age 14 years. As Keogh (1973) noted, it is "unusual in the senior high school if a girl runs, throws or jumps better than any but the poorer performing boy." These gains by boys are caused primarily by greater gains in strength and speed after puberty.

Movement Education

The essential idea behind movement education is in many ways embodied in the term"education through the physical" as opposed to "education of the physical". The movement education approach provides, ideally, an opportunity for the child to "discover" a variety of fundamental motor behaviors via an organized set of play and dance experiences. In the United States, motor development and elementary physical education have been influenced by movement education advocates in Europe and especially the British Isles. These advocates have sought to enhance the motor development of children via an educational system designed to help them understand the movement potential and capability of their bodies. As a result, programs of movement education are often characterized by an informal approach. Play settings are contrived by the teacher to encourage particular forms of activity, and once the child exhibits these activities the teacher seeks to improve on the quality of the movement. This approach is in sharp contrast to the traditional approach of teaching a specific activity via a formal set of teaching steps, and then, once the steps are completed, moving into another activity.

To successfully teach motor development under the movement education approach careful planning and monitoring of both the children and the activity setting are required. If correctly carried out a movement education approach can be extremely effective for children. If poorly planned the approach will produce a great deal of activity but it will be misdirected and of poor quality.

Perceptual-Motor Programs

Perceptual-motor programs began to emerge in the early 1960s from the work of psychologists and clinicians, in particular Ayres (1974), Doman (see Doman, Spitz, Zucman, & Delacato, 1960), Delacato (1964, 1966), Kephart (1960), and Frostig (Frostig & Horne, 1964). These researchers were strongly influenced by earlier workers whose concern centered on children with learning difficulties (see Wiederholt, 1974 for historical review). Three basic premises underlie these various perceptual-motor programs: (1) the belief in the close tie between sensory and motor processes; (2) the contention that sensorimotor development precedes and underlies all perceptual and intellectual ability; and (3) the belief that sequential motor development is mediated by and reflective of the development of the nervous system. Thus, the goal of these programs is not to treat motor disabilities but to remediate academic skills, such as reading and writing, through perceptual-motor training. Ayres' (1974) concern, for example, is not so much with improving motor skills but with improving brain function. Her program consists primarily of tactile and vestibular (balance) stimulation activities. The activities are said to improve brain-stem dysfunctions, claimed to be the source of many learning problems.

Others who adhere to the Doman-Delacato and Kephart approaches are concerned with developing specific motor patterns, believed to be prerequisities for the development of other skills, especially reading and writing. The Doman-Delacato program, in particular, requires strict adherence to a rigid set of activities. Doman and Delcato stress the

necessity of a recaptiulation of the sensorimotor sequence in order to retain the child in any motor pattern he or she might have skipped. This retraining, in turn, serves to improve nervous system function.

Balance beam walking, various locomotion patterns, such as hopping and crawling, angles-in-the-snow, and ball handling are typical activities in the Kephart program. Frostig emphasizes visual training and is more eclectic in her philosophy (Frostig & Maslow, 1979). However, her program activities and many of her premises are in agreement with the other perceptual-motor theorists.

The popularity of perceptual-motor programs grew in the 1960s and 1970s but created considerable controversy. Many educators, including physical educators, special educators, and classroom reachers, were skeptical of the claim that motor learning enhances academic abilities. Several researchers (see Glass, 1967; Hammill, Goodman & Wiederholt, 1974; Wedell, 1973 for review) attempted to substantiate the claims of the perceptual-motor theorists with intervention studies. Although the methodology of many of these studies was questionable with regard to actually being able to determine the efficacy of any progran, the general findings were not supportive of perceptual motor programs' ability to enhance academic learning (see Hallahan & Cruickshank, 1973; Myers & Hammill, 1976 for a complete review). As a result, the popularity of this type of program has recently diminished (Sherrill, 1981). Today, many researchers in programming draw from all of the approaches described above.

SUMMARY

Programs and activities to develop the motor abilities of children during their formative years are integral to the process of normal development. Programs of motor activity for the young child should begin with emphasis on informality and self-discovery to allow children to appreciate their movement capabilities. For young children, informal play settings with play equipment that encourages a variety of large muscle movements are important. Developing children must be able to appreciate the scope and potential of their motor abilities before the refinements and constraints of formal motor skills are placed upon them. As strength, dexterity, endurance, and flexibility develop, children will become receptive to the more formal motor skill activities that will become part of their experience.

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